Exploring the Content of Shared Mental Models in Project Teams

Sara McComb, PI

Award Number: N000140210535

Collaboration and Knowledge Management Workshop

14-16 January 2003

Overview

- Objectives
- Definitions
- Research Questions
- Conceptualization
- Experimentation
- References

Project Objectives

- To advance the theoretical understanding of shared cognition in project teams by:
  - Integrating existing theory in related fields to establish a model of shared mental model development
  - Validating the model through experimentation

Technical Objectives

- The proposed research has five technical objectives:
  - To establish a model of SMM development
  - To explore the way in which individually-held mental models converge among team members to become shared
  - To examine different means of measuring SMM
  - To distinguish among the multiple mental models working simultaneously within a team
  - To determine how SMM impact team performance

Next Year's Objectives

- Quasi-experiments
  - Continue data collection
- Controlled experiments
  - Complete specifications for experiments
  - Prepare experimental laboratory
  - Conduct experiments

Overview

- Objectives
- Definitions
- Research Questions
- Conceptualization
- Experimentation
- References

Cross-Functional Project Teams

A collection of
two or more individuals,
representing different functional areas,
assembled to work on
a time-limited, non-repetitive assignment.

Source: Cohen and Bailey, 1997

Taskwork vs. Teamwork

- Taskwork

  The functional job behaviors required to accomplish the assigned task.

- Teamwork

  The multitude of processes required to maintain the team such as cooperation, communication, interpersonal relationships.

Source: McIntyre and Salas, 1995

Related Constructs

- Cause maps
- Collective mind
- Schemas
- Shared cognition
- Sociocognition
- Team knowledge

Shared Mental Models (SMM)

"Knowledge [and belief] structures held by members of a team that enable them to form accurate explanations and expectations for the task, and in turn, to coordinate their actions and adapt their behavior to demands of [their unique situation].

Source: Cannon-Bowers, Salas, and Converse, 1993

Overview

- Objectives
- Definitions
- Research Questions
- Conceptualization
- Experimentation
- References

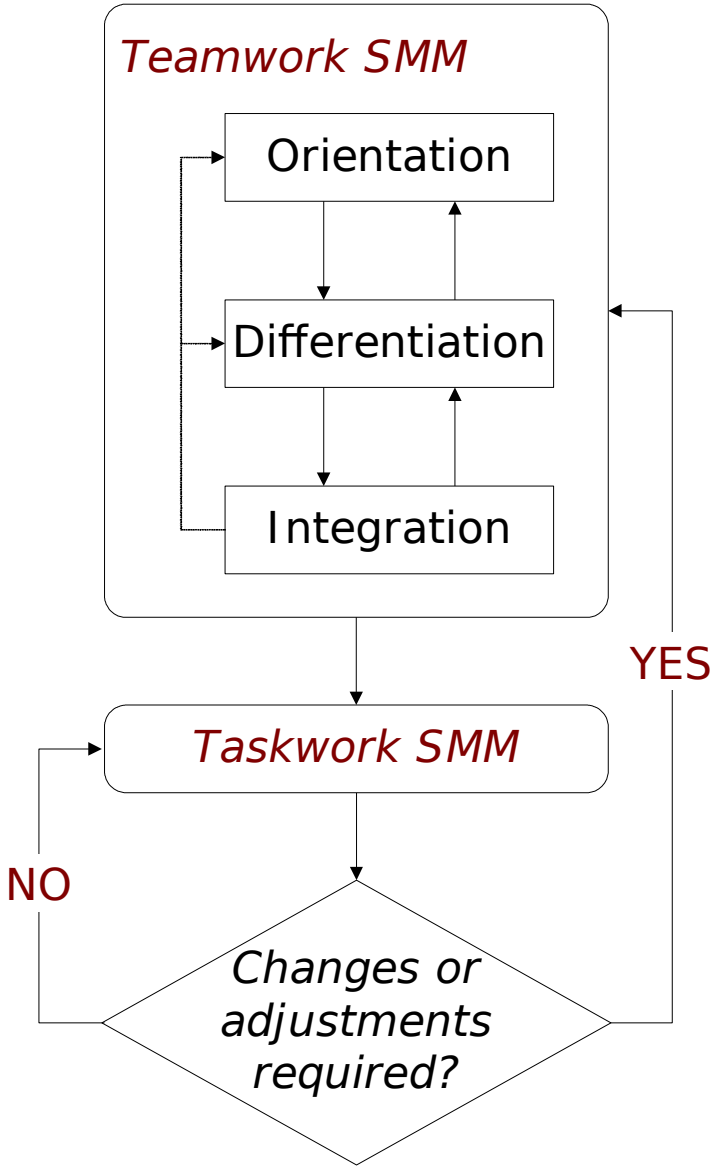
Research Questions

- What is the shared mental model development process?
- What is the appropriate shared mental model content for optimal teamwork?
- Do shared mental models impact team performance?

Overview

- Objectives
- Definitions
- Research Questions
- Conceptualization
- Experimentation
- References

SMM Development



Teamwork → Taskwork and Back

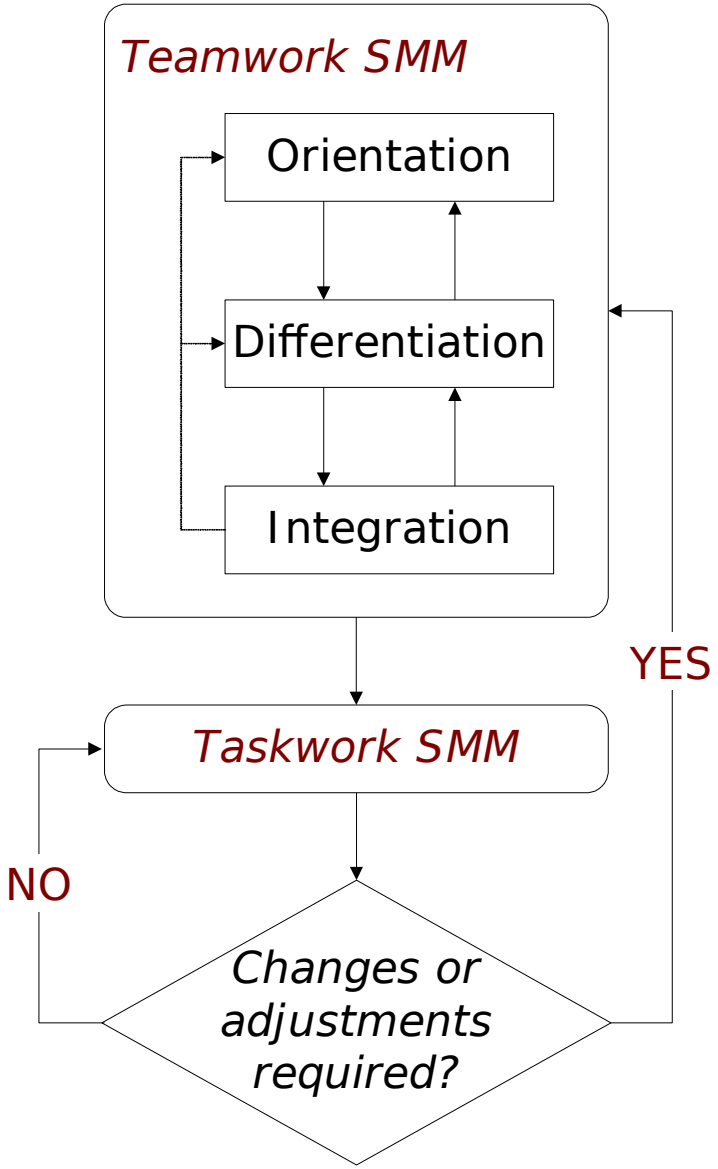
- The Shift
  - Conscious → Unconscious
    - automatic
  - Unconscious → Conscious
    - requires effort

Source: Louis and Sutton, 1991

Unconscious → Conscious

- The Catalysts
  - Novel circumstances
  - Discrepancies
  - Deliberate initiatives
- The Benefits
  - Overcome “cognitive inertia”
  - Improve overall SMM accuracy
  - Improve performance

SMM Development



Conceptualization: Teamwork & Information Processing

- Orientation
  - The sharing of information among team members about their unique domain
- Differentiation
  - The identification of multiple perspectives
- Integration
  - The reconciliation of the various perspectives into functioning mental representations

Integration and Sharing

Low Integration ⟷ **High Integration**

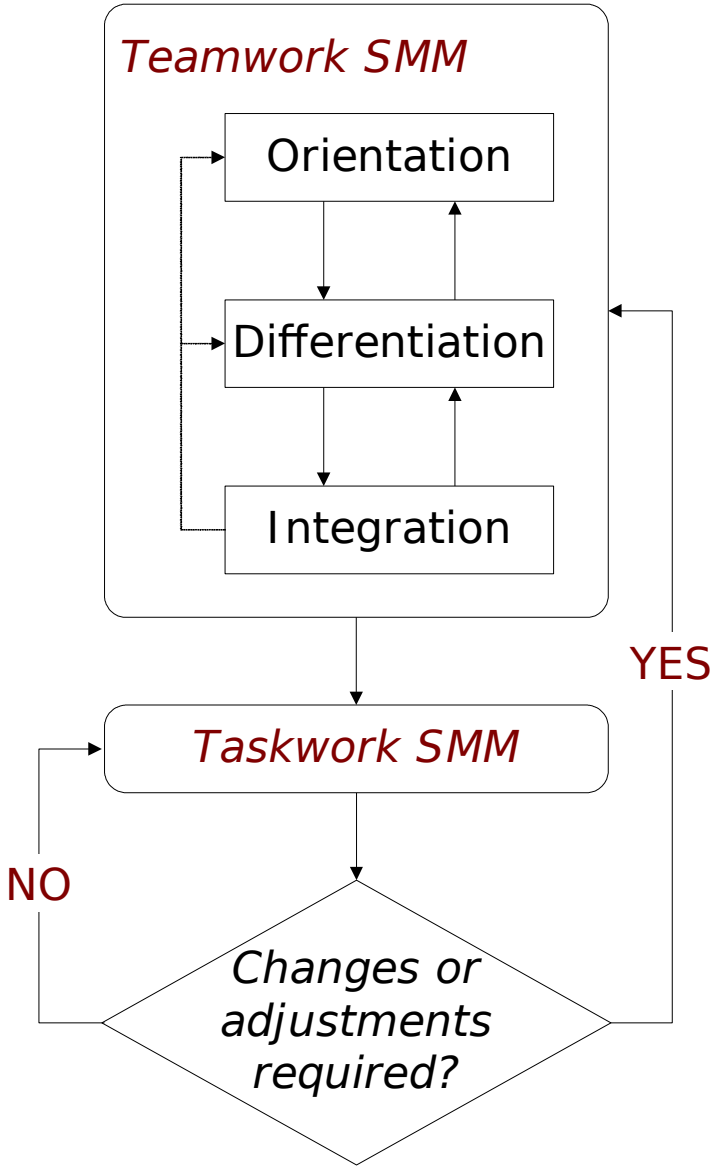
To have in common:

Compatible ⟷ **Overlapping** ⟷ **Identical**

To divide:

Single Individual ⟷ **Equitably Distributed**

SMM Development



SMM Content Requirements and SMM Development

Models	Integration
Team membership	Compatible
Project goals	Identical
Project work allocation	Equitably distributed
Project team interaction	Overlapping
Organizational climate	Compatible
Environmental context	Compatible

Publication of Conceptualization

- The Emergence of Shared Mental Models: Exploring the Intersection of Their Content and Development in Cross-Functional Project Teams
  - Submitted to the Academy of Management Conference
  - To be submitted to a Top Level Journal

Overview

- Objectives
- Definitions
- Research Questions
- Conceptualization
- Experimentation
- References

Experimentation Plan

- Experiment 1: Longitudinal quasi-experiment
- Experiment 2: Laboratory experiment
- Experiment 3: Replication and extension of laboratory experiment

Experiment 1

- A longitudinal quasi-experiment has been designed
  - To test for the convergence of the individually-held mental models and
  - To examine different means of measuring SMM

Experiment 1: Pilot

- 4 teams in Project Management class completing a semester long project
- 4 data collection points: Weeks 1, 2, 7, and 13
- Qualitative data collection

SMM Content Requirements

- Team membership
- Project goals
- Project work allocation
- Project team interaction
- Organizational climate
- Environmental context

Team Membership

- General knowledge about the contributions each team member can make to the team
- Pilot: Contributions of self and team members
- Results: Reported work allocation

Team Membership Example Team 1

- Time 4
  - Leader, coordinator
  - Leader, coordinator
  - Information processing
  - Information processing
- Represent work allocation among team members

Team Membership

- General knowledge about the contributions each team member can make to the team
- Pilot: Contributions of self and team members
- Results: Reported work allocation
- Revision: Individual contributions

  Assess competencies (e.g., initiative, teamwork and cooperation, flexibility, conceptual thinking)

Project Goals

- Specific knowledge about the scope of, and expectations for, the project
- Pilot: Describe project and sponsor expectations
- Results: Converged at either time 2 or time 3 (dependent upon team cohesion)

Project Goals Example Team 4

- Time 1
  - Strategic planning, recommend
  - Help planning team
  - Insight, evaluate requirements
- Time 2
  - Strategic planning, research
  - Future direction
  - What services to offer, budgets, funding, surveys
- Time 3
  - Research for strengths and opportunities
  - Survey
  - Data collection, compiling, provide results

Project Goals Example Team 3

- Time 1
  - ??
  - Help UCC
  - Survey, compare UCC, fiscal value
  - Survey, programs, fiscal value
- Time 2
  - Survey, fiscal value
  - Survey, 3 programs, fiscal value
  - Survey, 3 programs, place for UCC
  - Fiscal value, survey, compare methods
- Time 3
  - Survey; fiscal value; report
  - Survey; fiscal value
  - Survey; fiscal value
  - Survey; fiscal value

Project Goals

- Specific knowledge about the scope of, and expectations for, the project
- Pilot: Describe project and sponsor expectations
- Results: Converged at either time 2 or time 3 (dependent upon team cohesion)
- Revision: Minor rewording to ensure understanding of term sponsor

Project Goals – Performance Team 2

- Time 1
  - Better ways to sell calendars
  - Marketing plan
  - Help SN
  - Sell more calendars
- Time 2
  - Marketing plan
  - Sell more calendars
  - Increase sales
  - Try and increase sales
- Time 4
  - Marketing plan
  - Marketing plan, increase sales
  - Increase sales
  - Increase sales, create new contacts

Project Work Allocation

- Detailed knowledge of his/her required tasks and the corresponding interrelations among all team members' tasks
- Pilot: List tasks and identify who is responsible and who could be responsible
- Results: Varying levels of detail in responses
- Revision: Sentence stems regarding project team organization and work allocation

Project Team Interaction

- Knowledge of how team members plan to collaborate
- Pilot: Describe how team will work together
- Results: Only reported modes of communication used
- Revision: Replace with more specific sentence stems

Organizational Climate

- Beliefs about the way in which the organization values a team's work
- Pilot: Identify incentives for completing the project
- Results: Responses weren't common, but were consistent in behavioral implications

Organizational Climate Example Team 4

- Time 1
  - Internship opportunity, test skills
  - Information for library
  - Experience with teamwork, project management, get an A
- Time 3
  - grade, experience
  - Help library, get skills
  - Experience, good grade

Organizational Climate

- Beliefs about the way in which the organization values a team's work
- Pilot: Identify incentives for completing the project
- Results: Didn't converge, but responses were consistent in behavioral implications
- Revision: Added sentence stems regarding team experience and training

Environmental Context

- Beliefs about the way in which the assigned project will directly impact the organization's position in its competitive environment
- Pilot: Identification of who would be impacted by the project and how they would be impacted
- Results: Provided four groups because four boxes were given
- Revision: Changed format from one two-part item to two sentence stems

Lessons Learned

- SMM converge at the anticipated point in time
- Complicated questions don’t work
- Data collection timing is adequate
- Less initial information may be desirable
- Easy projects minimize interdependence required

Experiment 1

- Replicate and extend the pilot phase
- Increase sample size (approximately 20 teams currently identified)
- Improve and expand questionnaire

Revised Questionnaire

- Improve qualitative data collection
- Incorporate quantitative scales
- Compare the various means of assessment
  - Qualitative: project goals
  - Quantitative: contributions, interdependence
  - Combination: Beliefs – look for differences in qualitative and similarities in quantitative
- Validate measure accuracy

Experiment 2

- A set of controlled experiments is planned to determine the effects of
  - SMM content
  - SMM development
  - Virtuality

  on team performance.

Overview

- Objectives
- Definitions
- Research Questions
- Conceptualization
- Experimentation
- References

References

- Argyris, C. & Schön, D.A. (1974). *Theory in practice: Increasing professional effectiveness.* San Francisco, CA: Jossey-Bass.
- Cannon-Bowers, J.A., Salas, E., & Converse, S.A. (1993). Shared mental models in expert team decision making. In N.J. Castellan, Jr. (Ed.), *Individual and group decision making: Current issues*: 221-246. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Cohen, S.G. & Bailey, D.E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management*, 23: 239-290.
- Louis, M.R. & Sutton, R.I. (1991). Switching cognitive gears: From habits of mind to active thinking. *Human Relations*, 44: 55-76.
- McIntyre, R.M. & Salas, E. (1995). Measuring and managing for team performance: Emerging principles from complex environments. In R.A. Guzzo, E. Salas, & associates (Eds.), *Team effectiveness and decision making in organizations*: 9-45. San Francisco, CA: Jossey-Bass.
- Schroder, H.M., Driver, M.J., & Streufert, S. (1967). *Human information processing*. New York: Holt, Rinehart, & Winston.